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SYNCRUDE CRITERIA

ALBERTA
DEPARTMENT OF THE ENVIRONMENT
JANUARY, 1973

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OUTLINE OF THE REQUIREMENTS REGARDING ENVIRONMENTAL IMPACT TO TAR SANDS DEVELOPMENT

ENVIRONMENTAL IMPACT

The Department of The Environment is charged with the responsibility of initiating and co-ordinating action with other departments and agencies to maintain the quality of Alberta's environment and acts as the Provincial guardian of the environment. As guardian, the Department of The Environment has a legal and moral responsibility to maintain environmental quality, not only for this generation, but for succeeding generations as well.

Recognizing that the need for resources development, the quality of life and new industrial processes are not always compatible with environmental protection, the Department of The Environment has instituted a program designed to prevent or minimize deleterious environmental actions before they occur. The intent of the Department is to create an awareness of the importance of environmental quality and to elevate environmental considerations in project planning and design to a level equal with economic and technical considerations. Thus the emphasis is in prevention. It is recognized that the environment is a dynamic system and that alterations to the environment are not necessarily bad, particularly if they are planned, monitored and controlled to accomodate environmental quality requirements. The Department of The Environment can utilize assessment of environmental impact mechanisms to facilitate their evaluation of impact and assist in the decision-making process.

An assessment may be required by the Department when any irreversible or irretrievable commitment of resources are planned from the action, or which would curtail beneficial use of the

environment. Both the positive and negative facets of the impact must be assessed in a credit-debit relationship for environmental protection, for economic reasons and for effects on society. In cases where the net impact is judged to be beneficial, that shall not in itself, preclude the need for an assessment.

Assessment of environment impact does not take the place of approvals, permits, certificates, etc. In most cases, it will be filed as an attachment to an application for approval, permit, certificate, etc. and considered as scientific background as part of the decision-making process. However, the analyses must be conducted and the findings presented in such a manner that it can be reviewed and evaluated independently of other materials or documents.

The cold, hard facts are that when history is written, 100 or 500 years from now, the historians will record that Alberta did a good job or not, based primarily on the environmental and resource management principles that the government, industry and the people adopt during the decade of 1971-1980. Thus, environmental impact statements should aid in achieving the affirmative side of this objective to promote a balance between resource management, environmental protection and the quality of life.

OBJECTIVES OF THE ASSESSMENT OF ENVIRONMENTAL IMPACT

There are four basic purposes that must be considered in the preparation of an assessment of Environmental Impact. They are described below in order of relative importance.

1. Prevent or Mitigate Environmental Damage.
   The primary objective of the evaluation is to prevent or mitigate environmental harm before it occurs by:
   (a) requiring the company to consider and evaluate the environmental effects of the proposed action,
   (b) comparing environmental impact caused by utilizing alternate sites, methods, designs, techniques, etc., and by
   (c) Requiring that positive steps be taken to minimize deleterious effects and to repair, restore, reclaim or manage the environment in such a way that, if possible, some positive results can be achieved.
2. Educate and Inform Public Interests. The public has, in the last few years, developed a keen interest in environmental matters, and desires to be kept aware of new developments. An important objective is to present all salient facts to the attention of the public in such a way that they understand the issues involved. This provides the people (and their executor, the Provincial Government) with an oppor-

tunity to comment on the proposed action and to provide information concerning the project.

3. Justify the Proposed Action. Justification for the proposed action (including the basic need for the proposed action) together with justification of the chosen site and overall system design must be presented.

4. Contribution to Science. If the studies made for a proposed action are not recorded and made available for similar succeeding studies, then a scientific loss has been suffered. The documentation of these studies will permit a better evaluation of impact on subsequent studies.

The review of environmental impact will build into the governmental decision-making process a careful consideration of the environmental aspects of a proposed action, and will assist both the Government and the Company in their effort to minimize the impact. It is obvious that the investigation and report shall be of sufficient detail to allow reviewers to make a meaningful and substantive evaluation.

An assessment of environmental impact must be predictive in nature. The intent of the assessment is to impose the proposed action on baseline conditions, and to predict impact. Prediction does not imply guessing. Rather, a scientific approach, making full use of the literature and established scientific principles, should be employed. References should be cited where appropriate . In some cases, continuing monitoring programs may be planned to confirm predictions.

This, however, does not preclude the need for predictive statements, and periodic reports should be filed describing the results of the program.

An implied but important objective of the assessment is to encourage proper rapport among appropriate parties before the program or project has progressed to the point where it cannot be practically stopped or modified, even if substantial environmental dessication will result. Early planning and coordination with appropriate agencies will eliminate the necessity for program delay or modification during later stages.

It is not intended to generate thick reports filled with superfluous material. Reports should be terse and succinct. Reports containing unnecessary and extraneous material are subject to rejection on the basis that the review process by government agencies would be unnecessarily time-consuming and costly. Authors are advised to treat pertinent material completely and adequately, but not the point of including irrelevent detail.

The scope and depth of analysis of each item will vary considerably from case to case. It is the responsibility of the author to determine the amount of description that is necessary so that the impact on each can be adequately and accurately assessed. Descriptions should discuss stream flow, lake levels and ground-water conditions so that the impact of withdrawals and/or discharge can be described. Ambient air quality and meteorologic conditions should also be described.

Terrestrial biologic conditions should be evaluated in terms of habitat classification. Botanical associations should be identified and presented on a map. Animals should be described, with emphasis given to the higher trophic levels. Lower levels should be addressed only to the extent necessary to describe basic characteristics and ecological characteristics of the higher forms. Aquatic biology, too, should emphasize the higher levels, and lower levels addressed as necessary to evaluate the condition of the higher levels.

Where applicable, socio-economics should address population and demography and direction and proximity to population centers. Land-use patterns, such as agricultural, urban, recreation areas, etc. should be delineated. If economic conditons are likely to be affected by the proposed action, and analysis of income, tax bases, etc. should be investigated. In cases where permits, licences or certificates are required for construction or operation of the proposed action, their issuance will be contingent upon a satisfactory assessment of environmental impact. This assessment must demonstrate that the benefits to be derived from the proposed action outweigh the environmental costs and that all precautions are being taken to minimize the degredation of the environment.

It is suggested that the company discuss with the department, such items as scheduling and particularly sensitive areas that the department feels must be addressed in the assessment.

The staff of the Department of Environment is willing to provide advice and consultation to the company during the assessment; however, because of personnel limitations, they

cannot participate actively in any study. The report must include an adequate description of baseline conditions, the proposed action, program or project and the resulting impact on the environment.

OUTLINE OF THE REQUIREMENTS

OF THE

WATER RESOURCES ACT

WITH SPECIFIC REFERENCE TO

TAR SANDS DEVELOPMENT

OUTLINE OF THE REQUIREMENTS OF THE WATER RESOURCES ACT WITH SPECIFIC REFERENCE TO TAR SANDS DEVELOPMENT

The Water Resources Act applies to all water in the province, both surface and ground water.

A licence is required for:

1. The diversion of water for any purpose;
2. The use of water for any purpose;
3. The construction and operation of works for the diversion and use of water.

Prior to the filing of a formal application to divert water, the Act provides for the issue of a preliminary permit to undertake such examination and surveys as are required to determine the feasibility of the undertaking. A preliminary permit for surface water investigations is issued at the discretion of the Minister; a preliminary permit for ground water investigations is mandatory before an application may be filed to divert ground water.

Syncrude currently has a preliminary permit which expires on 27 January, 1973, for the purpose of making surveys to determine the feasibility of diverting Beaver Creek into Poplar Creek and utilizing Mildred Lake as a reservoir and cooling pond. If sufficient data has been collected the company may now file a formal application for the proposed diversion, otherwise the company should apply for an extension of the preliminary permit.

A preliminary permit for ground water exploration and evaluation has not yet been issued. An application for same should contain:

1. Details of area to be dewatered.
2. Proposed location of pumped (dewatering) wells.
3. Proposed location of observation wells.
4. The point or points of disposal of pumped water.
5. Statement indicating the anticipated effect on the ground water regime.

A preliminary permit does not convey any right to the diversion or use of water nor authorize the construction of works except such site investigations, test drilling and pump testing as is necessary to evaluate the feasibility of the proposal.

An application for a licence under The Water Resources Act must be supported by plans, reports and specifications in sufficient detail to permit evaluation of alternatives and an evaluation of the effect of the proposal on:

1. Sources of water supply, both surface and ground water,
2. other users, and
3. the environment.

Specifically, an application under the Act shall contain:

1. Plans of those works which divert or otherwise directly affect streams or water bodies including:
   (a) A general plan of the plant and lease area showing location of the plant, diversion works to be constructed and water bodies affected.
   (b) Detail plans (construction drawings) of those works which divert, impound or convey water, or return water to a source body.

To permit evaluation of alternatives and the effects of the development, preliminary plans may be filed initially provided that actual construction drawings are submitted for approval prior to issue of formal authorization to construct said works.

2. Copies of reports evaluating the effect of both the surface and ground water diversions. An outline of more specific content of these reports, to satisfy requirements for water diversion as well as watershed protection, may be found under the heading "WATERSHED PROTECTION" on pages 41, 42 and 43.

3. In the main the tar sands development envisions massive diversions of surface and ground water for disposal through drainage facilities. Requirements for water to be diverted and used in plant processes must be specifically identified as to quantity and rates of diversion:

   (a) A tabulation for a typical initial year of operation showing the gross diversion requirements month by month, the estimated quantities consumed or otherwise lost during the process and the quantities returned to natural water bodies or to artificial impoundments.

   (b) A tabulation showing the estimated annual diversion requirements for the life of the project, or as a minimum, for the first 10 to 20 years of operation.

An application for a preliminary permit or for a licence may be filed with the Associate Director, Earth Sciences and

Licencing Division of the Department of The Environment.

Following assessment of the application the Minister may issue an interim licence (an authorization to construct the approved works) subject to such terms and conditions as are deemed necessary. After completion of the works a licence is then issued for the continued diversion and use of water for the life of the project, subject to review as necessary to meet changing conditions.

OUTLINE OF THE REQUIREMENTS

OF THE

CLEAN AIR ACT

WITH SPECIFIC REFERENCE TO

TAR SANDS DEVELOPMENT

DESIGN INFORMATION

According to the provisions of the Clean Air Act, design information relating to atmospheric emissions at existing and new tar sands plants shall be forwarded to the Director of Standards and Approvals, Department of the Environment, prior to construction. Tar sands plant operators will be required to obtain a permit to construct and a licence to operate a new plant or any major extension, or alteration of an existing plant. In making application, the following general information will be required:

1. Plant location - legal description and topographical plan of the area;
2. Raw material to be processed - volume and composition;
3. Products and by-products - amount and rate of production;
4. Loss of materials - amount and rate;
5. Pertinent material balance;
6. Air contaminants - source - amount - nature - rate of production - treatment - disposal; and
7. Rate and manner of release of air contaminants.

The prime consideration in developing air contaminant emission standards is the preservation of the ecological integrety of any area which could be influenced by emissions from tar sands plants for the protection of plant and animal life indigenous to this area.

Taking into consideration the technology that is currently available in the areas of process control and plant operating

techniques, it is felt that the limitations respecting maximum allowable rates of emission of the various contaminants, to which references have been made, are realistically and readily achievable.

A Draft document of a "Permit to construct" is attached, to indicate specifically those items regarding environmental matters that are of concern.

A critical and important assumption made in the development of sulphur dioxide emission allowables was that five plants (design and capacity of Syncrude) would be built in a line spaced at approximately five miles apart. The constraint would therefore be the cummulative effect of overlapping stack plumes from the five plants and the process and stack designs must be such that the calculated ground level concentration does not exceed 0.20 ppm. With this restriction, the individual plants must base their designs so that the calculated ground level concentration does not exceed 0.06 ppm, with respect to sulphur dioxide. The main source of sulphur dioxide emissions at both the proposed Syncrude and existing G.C.O.S. plants is the boiler plant fuel. The maximum release rate of sulphur dioxide to the atmosphere from the Syncrude plant indicated in this permit is 140 long tons per day.

Included among the air contaminants which the Department of the Environment considers to be of prime concern, besides those of sulphur bearing compounds, are oxides of nitrogen and particulates (including heavy metals). These and any contaminants considered to be potentially detrimental to the environment, shall be released

to the atmosphere through one main stack. Operators of tar sands processing plants will be required to implement the "best practicable technology in restricting the release of any air contaminants to the atmosphere".

TABLE 1

SULFUR RECOVERY GUIDELINES

Inlet Rate to Plant (Long Tons of Sulfur per day)	Sulfur Recovery Efficiency (Percent)
1000 - 4000	98.5
400 - 1000	97.0
100 - 400	95.0
10 - 100	93.5

MAIN STACK GAS MONITORING

1. Continuous

All tar sands processing plants emitting more than 5 long tons of sulfur per day shall continuously monitor stack gases for sulfur dioxide concentration, volume flow rate and temperature.

2. Periodic

All tar sands processing plants shall be periodically sampled and measurements made for:

(a) Concentration of sulfur dioxide, oxygen, carbon dioxide and water vapor;

(b) Volume flow rate;

(c) Temperature.

These surveys shall be conducted according to the following frequency:

Maximum Allowable Sulfur Emission Rate *LTS/D	No. of Stack Surveys Per Year
120 - 149	8
90 - 119	7
60 - 89	6
30 - 59	5
15 - 29	4
10 - 14.9	3
5 - 9.9	2
1 - 4.9	1
Less than 1	As required

*LTS/D - Long Tons of Sulfur emission per stream day.

AMBIENT MONITORING

1. All tar sands processing plants shall be required to implement both continuous and static monitoring programs for the determination of sulfur dioxide and hydrogen sulfide according to the following schedule:

Maximum Allowable Sulfur Emission Rate *LTS/D	Continuous No. of Stations	Mo./Yr.	Static No. of Stations
120 - 149	5	12	40
90 - 119	4	12	35
60 - 89	3	12	30
30 - 59	2	12	25
15 - 29	1	12	20
10 - 14.9	1	9	16
5 - 9.9	1	6	12
3 - 4.9	1	3	8
1 - 2.9	1	2	4
Less than 1	As required	As required	2

*LTS/D - Long Tons Sulfur emission per stream day.

2. All tar sands processing plants producing elemental sulfur shall establish a sulfur dustfall exposure cylinder network for the measurement of elemental sulfur according to the following schedule, except as noted below the schedule:

Sulfur Production LTS/D	No. of Sulfur Dustfall Exposure Cylinders
Greater than 1000	12
100 - 1000	8
Less than 100	4

(a) Those plants shipping their total sulfur production in liquid form are exempted from sulfur dustfall monitoring.

(b) Those plants stockpiling but not shipping sold sulfur are permitted to reduce the number of sulfur dustfall stations to one half of that shown in the schedule provided that the minimum is not less than four.

(c) Those plants exempted in part 2 above, must expand their network to the full compliment at least three months prior to break up of the sulfur stockpile.

APPLICATION FOR A PERMIT TO CONSTRUCT A TAR SANDS PROCESSING PLANT

1. (a) No person shall commence the construction of a plant unless he is a holder of a permit therefore issued by the Director of Standards and Approvals.

   (b) An application shall be submitted and signed by the owner of the plant or his agent.

2. (a) The application for a permit shall be made in writing to the Director of Standards and Approvals at least one year before construction is proposed to commence.

   (b) An application for a permit must be accompanied by:

      (i) information concerning the plant specified in subsection (3);

      (ii) at least one scale plan of the area surrounding the land on which the plant is to be situated, showing the matters specified in subsection (4);

      (iii) at least one scale plan of the land on which the plant is to be situated showing the matters specified in subsection (5);

      (iv) a flow diagram of the matters specified in subsection (5);

   (c) An application for a permit shall contain the following information where applicable, with respect to the plant:

      (i) its general nature;

      (ii) the type and quantity of the product resulting from the plant;

      (iii) the size and capacity of equipment used;

(iv) type and amount of raw materials used;

(v) type and amount of chemicals and processing materials used;

(vi) the method by which and the manner in which any air contaminant will be released or discharged from or by the plant;

(vii) the composition of every effluent stream which will be emitted or discharged from or by the plant under normal and maximum operating conditions;

(viii) the volumetric rate, velocity and temperature of the release of every effluent stream under normal and maximum operating conditions;

(ix) the weight per day of the air contaminant released to the atmosphere;

(x) whether the composition of any of the effluent streams will vary under different operating conditions whether the operating conditions are internal or external in nature;

(xi) the calculated ground level concentration of every air contaminant (except particulates) released by or from the plant under maximum operating conditions;

(xii) a description of the contingency procedure that will be taken to prevent the discharge of untreated wastes in the event of power failure, mechanical failure of the pollution control facilities or any failure of the plant's manufacturing equipment;

(xiii) the proposed method and frequency of monitoring and

analytical determination for monitoring effluent streams; and

(xiv) a statement of:

(1) the raw materials, chemicals and processing materials used in the plant;

(2) the finished product resulting from the plant, and

(3) the materials balance of the matters referred to in clauses (1) and (2) to the actual air contaminants emitted or discharged respectively to land, air and water.

(d) The scale plan of the area surrounding the land on which the plant is to be situated must show:

(i) the topography of the area including the land contours,

(ii) the type of buildings in the area,

(iii) property boundaries, and

(iv) the land use of the area.

(e) The scale plan of the land on which the plant is to be situated must show:

(i) the exact location of the processing, manufacturing, storage and other units,

(ii) the location of all air contaminant control equipment,

(iii) the location of all other buildings, and

(iv) the points of emission or discharge of air contaminants by or from the plant and their elevation.

3. Each application for a permit shall be accompanied by the fee required to be paid pursuant to the Clean Air (General) Regulations.

4. Where the Director of Standards and Approvals is satisfied that a permit should be issued, he shall issue a permit in accordance with the Clean Air Act.

APPLICATION FOR A LICENSE TO OPERATE OR USE A TAR SANDS PROCESSING PLANT

5. (a) No person shall commence the operation or use of a plant unless he is the holder of a license issued by the Director of the Division of Standards and Approvals.

   (b) An application shall be submitted and signed by the owner of the plant, or his agent.

6. (a) The application for a license shall be made in writing to the Director of the Division of Standards and Approvals at least 90 days before the owner proposes to operate or use the plant.

   (b) An application for a license must be accompanied by:

      (i) the number of the permit to construct the plant,

      (ii) detailed information as to any changes to the information supplied under Section 4, with where appropriate, new plans, diagrams, and statements.

7. Each application for a license shall be accompanied by the required fee to be paid pursuant to The Clean Air (General) Regulations.

8. Where the Director of the Division of Standards and Approvals

is satisfied that a license should be issued, he shall issue a license in accordance with The Clean Air Act.

9. Where a license is issued, it is valid for a period not to exceed five years from the date of issuance.

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ENVIRONMENT

ERMIT TO CONSTRUCT

ERMIT NO. .....

LE NO. .....

O Syncrude Canada Limited

200 Baker Building
EDMONTON, Alberta

rsuant to section 4 of The Clean Air Act, a permit to construct

a Tar Sands Processing Plant located in the Athabasca Oil Sands as described in the above company's submission to the Energy Resources Conservation Board (Application No. 5849)

ereby issued subject to the terms, conditions and requirements attached hereto.

..... 19 ...

.....
Director of Standards and Approvals

A. DESIGN AND EMISSION STANDARDS

(1) The plant referred to herein includes those buildings, structures, operating and storage facilities, and land located in Bituminous Sands Lease No. 17, Section 6, Township 93, Range 10, West of the 4th Meridian.

(2) The plant may be operated up to a maximum capacity of 140,000 barrels per calendar day of bitumen feed to upgrading.

(3) Any contaminants released from the plant boilers and the sulphur plant incinerator shall be discharged to the atmosphere through one main stack which shall be a minimum of 400 feet in height with a minimum flue gas emission temperature of 500 degrees Fahrenheit.

(4) The concentration of sulphur dioxide in the flue gas being exhausted to the atmosphere from the main stack shall not exceed a maximum one-half hour average of 1400 parts per million by volume or a maximum 24 hour average of 1200 parts per million by volume.

(5) The maximum rate of release of sulphur dioxide to the atmosphere from the main stack shall not exceed 140 long tons per day or 2.92 long tons in any half hour period.

(6) The sulphur recovery unit shall be operated to recover in the form of elemental sulphur not less than 97.0 percent of the sulphur contained in the raw gas delivered to the plant during each three month period commencing January 1, April 1, July 1, or October 1.

(7) The plant shall be provided with a duplicate standby sulphur recovery train in a warm idling condition for instantaneous commissioning should the need arise. Ample fuel gas must be available to flare any acid gas that may result in this switch over.

(8) (a) The design of the plant shall be such that the release of sulphur dioxide to the atmosphere does not result in a calculated one-half hour average ground level concentration exceeding 150 micrograms per cubic metre (approximately 0.06 parts per million by volume).

(b) The operation of the plant shall be such that the release of sulphur dioxide to the atmosphere does not result in an ambient one hour average concentration exceeding 450 micrograms per cubic metre (approximately 0.17 parts per million by volume) or an ambient one-half hour average concentration exceeding 525 micrograms per cubic metre (approximately 0.20 parts per million by volume) of sulphur dioxide at ground level or at any other point of impingement.

(9) (a) The design of the plant shall be such that the release of nitrogen oxides to the atmosphere does not result in a calculated one-half hour ground level concentration exceeding 120 micrograms per cubic metre (approximately 0.06 parts per million by volume) expressed as nitrogen dioxide.

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(b) The operation of the plant shall be such that the release of nitrogen oxides to the atmosphere does not result in an ambient one hour average concentration exceeding 400 micrograms per cubic metre (approximately 0.20 parts per million by volume) expressed as nitrogen dioxide at ground level or at any other point of impingement.

(10) The emission of particulates to the atmosphere from the main stack shall not exceed 0.20 pounds per 1000 pounds of flue gas adjusted to 50 percent excess air.

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B. GENERAL

(1) All odorous materials are to be handled in such a manner as to prevent the emission of objectionable odors by confining them at the source. Spills of odorous material must be cleaned up in a manner satisfactory to the Director of Pollution Control.

(2) Should strong or offensive odors be detected frequently outside the plant, the Director of Standards and Approvals may require the company to carry out an odor survey, determine the possible sources of the odor and report the findings to the Director for assessment. Such a survey must be initiated by the company and carried out in a manner satisfactory to the Director at the company's own expense.

(3) Smoke resulting from either flaring operations or burn pit systems must comply with the limitations specified in The Air Contaminant (Maximum Levels) Regulations.

(4) All tankage shall be designed and equipped for vapor and gaseous emission control as follows:

(a) All crude oil tankage and those tanks that are over 50 feet in diameter holding stocks with a vapor pressure of 3 to 12 pounds per square inch absolute shall be provided with a floating roof designed with a closure seal or seals to close the space between the roof edge and the tank wall.

(b) All stocks with a vapor pressure greater than 12 pounds per square inch absolute shall be stored in closed vessels or pressure spheres.

(5) The operation of the plant shall be such that a minimum of unburned hydrocarbons are released to the atmosphere.

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C. MONITORING AND RETURNS

(1) Monitoring - In a manner satisfactory to the Director of the Division of Standards and Approvals:

(a) The main stack shall be:

i) Automatically monitored on a continuous basis for sulphur dioxide, particulates, volume flow rate and temperature.

ii) Stack surveyed six times per year and the following determinations made:

- the rate of flow of sulphur dioxide, oxides of nitrogen, particulates, carbon dioxide, nitrogen, oxygen and water vapor;

- the flue gas volume flow rate and temperature.

(b) A minimum network of thirty static exposure cylinder stations for the detection of hydrogen sulphide and total sulphation shall be maintained at suitable locations around the plant.

(c) A minimum network of eight sulphur dustfall stations shall be maintained at suitable locations around the sulphur storage area.

(d) Representative samples of particulate matter being exhausted from the main stack shall be analyzed for total heavy metals content at approximately three month intervals for the first year of operation and in future years at a frequency to be determined by the Director.

(e) Three continuous ambient air quality monitoring surveys for sulphur dioxide and hydrogen sulphide concentrations, wind speed and wind direction shall be conducted for a twelve month period each year.

(2) Returns - The monitoring information referred to in paragraph (1) above shall be tabulated and summarized in the form of a monthly report and forwarded to the Director of the Division of Pollution Control within twenty days of the end of the month for which the observations were made. The monthly report shall include any significant information related to contaminant emissions including the following items:

(a) The maximum instantaneous peak, maximum one-half hour average and average daily values for the concentration of sulphur dioxide and particulates in the main stack flue gases;

(b) The maximum one-half hour average and average daily values for the number of long tons of sulphur dioxide emitted from the main stack;

(c) The minimum and average daily values for the exit temperature of

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the main stack flue gases;

(d) The daily amount of raw bitumen to upgrading and the sulphur content;

(e) The daily amount of synthetic crude oil produced and the sulphur content;

(f) The daily amount of sulphur produced;

(g) The results of the total heavy metals analyses;

(h) The results of both the static and continuous ambient air quality monitoring surveys;

(i) The results of the stack survey carried out during the month; and

(j) Remarks relative to the performance of the air pollution control program including an interpretation of significant variations.

(3) A materials balance statement shall be prepared and submitted to the Director of the Division of Pollution Control on a monthly basis. This report shall indicate the quantity and character of process materials and raw materials to the plant and their disposition as related to air, water or land.

(4) All uncontrolled releases of air contaminants from the plant and occurrences of non-compliance with any condition of this approval shall be reported to the Director fo the Division of Pollution Control within 24 hours.

(5) The company shall report and confirm to the Director of the Division of Pollution Control any occurrences of non-compliance with the conditions of this approval, in writing, within 72 hours.

(6) An annual summary and evaluation report of the performance of the air pollution control facilities and systems, together with the related quality and quantity of air contaminants released to the atmosphere shall be prepared and forwarded to the Director of the Division of Pollution Control by February 14 of the year following the year in question. This annual report shall include remarks pertaining to minor extensions and alterations, and photographs or 35 millimeter slides of the air pollution control facilities.

(7) The company shall at all times conduct and control their operations in such a manner as not to create a hazard to the public and shall take all reasonable precautions to protect and safeguard the lives and property of the public and adjacent property owners.

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D. STOP ORDERS AND EXPIRY DATE

(1) (a) Pursuant to and in accordance with the provisions of The Clean Air Act, the Minister of the Environment may issue a stop order to the company or any person where the provisions of the Act, regulations and orders thereunder, or the conditions of this approval have been contravened or where the Minister considers any structure or thing to be a source of air pollution representing an immediate danger to human life or property or both.

(b) In a stop order, the Minister may require that the person to whom it is directed

i) cease the contravention specified in the order, and

ii) stop any operations or shut down or stop the operation of any plant, equipment, structure or thing either permanently or for a specified period.

(2) This approval is granted on the basis of current knowledge, technology, circumstances and the conditions and requirements or any of them may be revised, amended or revoked if deemed necessary by the Director of the Division of Standards and Approvals. In any event, this approval shall expire December 31, 1977.

H. L. HOGGE, DIRECTOR

OUTLINE OF THE REQUIREMENTS

OF THE

CLEAN WATER ACT

WITH SPECIFIC REFERENCE TO

TAR SANDS DEVELOPMENT

DESIGN INFORMATION

Approval of waste water management facilities by the Department of the Environment for new facilities prohibits the release of untreated tailings pond waste waters into any water course or body of fresh water. Any application by tar sand operators for the use of existing lakes as a tailings disposal site shall have supporting documentation of the potential long and short term effects on the ecological integrity of the local area. Operators of tar sands plants are required to treat waste waters from the bitumen upgrading facilities according to the "best practical technology" prior to any release to surrounding watershed areas under the provisions of the Clean Water Act, design information relating to the waste water management program at existing and new tar sands plants shall be forwarded to the Director of Standards and Approvals, Department of the Environment. Tar sands plant operators will be required to obtain a permit to construct a new plant or any major extension or alteration of an existing plant. A licence to operate these facilities will also be necessary and generally the following information will be required:

(1) Plant Location - legal description and topographical plan of the area;

(2) Raw material to be processed - volume and composition;

(3) Processing chemicals or materials to be used - type, composition and rate of consumption;

(4) Products and by-products - amount and rate of production;

(5) Loss of materials - amount and rate;

(6) Pertinent material balances;

(7) Water contaminants - source - amount - nature - rate of production - treatment - disposal;

(8) Where disposal of extraction plant and bitumen upgrading plant waste waters is to a recycle tailings pond, the construction drawing or plan showing all pertinent dimensions, together with design flow rate of waste waters and assumed surface evaporation, seepage, and recycle rates shall be included with the design information;

(9) Method of handling storm water from buildings - process area - product storage areas - areas surrounding the plant;

(10) Rate and manner of release of water contaminants and the receiving body of water (where disposal is to a surface water).

The format of approving waste water treatment facilities by the Department of the Environment by any approval, permit or licence under the Clean Water Act for tar sand operations is based on maximum reuse of tailings pond water from the extraction plant, utilities plant and surface runoff. Existing plants will be required to control releases of treated process waste waters to surrounding watersheds in accordance to the standards prescribed herein.

PROCESS WASTE WATERS

The definition of process waste waters from tar sands plants included those waste waters originating from the mine

pit area, the extraction and bitumen upgrading plants and include the following: mine runoff water, tailings pond hydrocarbons, floor washings, steam condensate, cooling tower and boiler blowdown water, amine clean-up system water and glycol residuals. All waste waters from the extraction plant shall be directed to an approved tailings pond site for the purpose of maximizing recycle rates of water reuse. Where possible, waste waters from the bitumen upgrading plant shall also be directed to the tailings pond for maximum reuse. Where the volume of waste waters from the bitumen plant is sufficiently large to require continuous discharge to the surrounding watershed area, suitable waste water treatment facilities are required. Physical and biological treatment facilities include the following: sour water stripper, API separator, aerated lagoons or equivalent secondary treatment facilities and emergency storage ponds. Waste waters released from these facilities are required to be controlled within specific waste water emission standards that are sufficiently stringent to protect fish and wildlife within the receiving watershed area. The levels of water contaminants contained in treated process waste waters that are discharged into adjacent watershed areas from existing pilot and full-scale tar sands plants shall not exceed those values listed in Table I. Where the quality of waste water effluents presently being discharged from existing plants is superior to these standards, then the existing level of high quality shall be maintained.

Compliance with the numerical standards of water contaminants in Table I shall be determined on the basis of a 24

hour composite sample as follows:

(1) A composite sample consisting of not less than twelve portions prorated intervals over a 24 hour period.

(2) The emission rates, values, and concentrations shall be based on the analytical results of the composite sample and determined from the flow volume for that 24 hour period during which the composite sample was collected.

In addition, no water contaminant as determined by an analysis of a representative grab sample collected at any time shall exceed 1.5 times the numerical standard of concentration prescribed in Table I. The range of pH limitation is not subject to variance and must be met at all times. Analysis of the composite sample shall be in accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater", as published by the APHA, or alternative procedures approved by the Director of Standards and Approvals.

Emission rates in terms of a permitted release (lbs/MBCD) of water contaminants from the bitumen upgrading plant will be specified for each tar sands plant according to Table I. Variance of these standards may be dependent on the combination of the following factors:

(1) average dry weather flow rate of process waste waters to the surrounding watershed area;

(2) nature and capacity of unit operations; and

(3) design capacity of the total plant based on bitumen feed to the upgrading plant (1000 barrels per calendar day).

Additional standards are being developed accordingly

and include an acute toxicity requirement for a biological assay on rainbow trout and a restriction on the release of specific toxic elements (i.e. heavy metals) where necessary. Proposed standards of toxic elements are listed in Table II. Bitumen upgrading plant effluents should be non-toxic to fish.

SANITARY WASTE WATER

During the construction of new tar sands plants or major expansion of existing plants, adequate sanitary control facilities are required for sanitary wastes originating from the construction camp. Underground facilities such as septic tanks and tile field disposal, aeration package units, or sewage lagoons may be used for treating these wastes. The use of septic tank and tile field disposal facilities are generally suitable for treating sanitary wastes originating from plant operating personnel. This may not be adequate for a construction camp. If sewage treatment ponds are contemplated, then sanitary sewage shall be contained in the sewage lagoons for a minimum period of 24 months. These waste waters can then be subsequently released to the surrounding watershed area in a controlled manner during the period of spring runoff when natural drainage courses are in flood.

SURFACE RUNOFF

Storm water precipitation and surface drainage is required to be collected and controlled so that these waste waters are prevented from mixing with any spilled liquid

hydrocarbons or sulphur dust from the process areas. Settling ponds are required to deposit settleable solids and separate floatable oil material. Additional facilities (chemical treatment) may be required to remove oil-water emulsions. The quality of treated storm runoff waters from primary treatment facilities (minimum of 4 hours detention time at maximum design rate of flow) shall be controlled to meet 50% of the water contaminant levels specified in Table I.

Emission rates or release (lbs/day) will be established accordingly. These emission rates will depend on the nature of the receiving watershed area, local evaporation - precipitation data, capacity of settling ponds and will also protect the local aquatic environment.

OIL-FREE WATER

Oil-free water that has not come in contact with hydrocarbon materials are generally free of water contaminants. Cooling tower and boiler blowdown water contain minor concentrations of scale forming, corrosion, and biological inhibitors. These waste waters can be directed to approved watershed areas after treatment. However, the thermal energy of these waste waters and the amounts of water contaminants shall be controlled so that fish and wildlife are not significantly affected.

APPROVAL OF NEW TAR SANDS PLANTS

Approval of the waste water management program for new plants by issuance of an approval or a permit - licence under the Clean Water Act include the following general terms and conditions:

TABLE I

STANDARDS OF TREATED PROCESS WASTE WATERS RELEASE FROM THE BITUMEN UPGRADING PLANT TO WATERSHED AREAS

WATER CONTAMINANT OR CONSTITUENT	EMISSION RATE *(lbs/MBCD)	CONCENTRATION (mg/l)
Chemical Oxygen Demand	150	150
Biochemical Oxygen Demand	50	50
Suspended Solids	25	25
Sulfide (total)	0.2	0.2
Ammonia Nitrogen	10	10
Oil and Greases	10	10
Phenolics	0.5	0.5
Threshold Odor Number	1000 units	1000 units
pH	6.5 - 9.5	6.5 - 9.5

* lbs/MBCD - pounds of water contaminants per 1000 barrels of bitumen feed to the upgrading plant per calendar day.

TABLE II

STANDARDS OF TOXIC ELEMENTS CONTAINED IN TREATED PROCESS WASTE WATERS RELEASED FROM THE BITUMEN UPGRADING PLANT TO WATERSHED AREAS

TOXIC ELEMENTS (TOTAL)	EMISSION RATE ** (lbs/MBCD)	CONCENTRATION (mg/l)
Arsenic	0.25	0.25
Barium	1.0	1.0
Cadmium	0.10	0.10
Chromium (Hexavalent)	0.30	0.30
Copper	1.0	1.0
Cyanide	0.025	0.025
Iron	1.0	1.0
Lead	0.10	0.10
Manganese	1.0	1.0
Mercury	0.0005	0.0005
Nickel	1.0	1.0
Selenium	1.0	1.0
Silver	0.10	0.10
Zinc	1.0	1.0

*Note: The accumulative total toxic element limit of any individual effluent discharge shall not exceed an emission rate of 5 lbs/MBCD or a concentration of 5 mg/l.

** lbs/MBCD - Pounds of toxic elements per 1000 barrels of bitumen feed to the upgrading plant per calendar day.

(1) Release of water contaminants originating in waste waters from the extraction plant process area to the surrounding watershed area or to ground water shall be minimized. The ecological integrity and productivity of existing lakes that are used for disposal of tailings wastes, cooling water and boiler water blowdown shall not be significantly diminished. Where necessary, the operator shall endeavor to establish a simulated natural watershed environment elsewhere.

(2) Adequate precautionary measures to control sulphur dust shall be implemented in order to minimize contamination of the surrounding land and watershed area.

(3) Surface runoff waters originating or passing through the sulphur storage, crushing, slating, transfer and loading areas shall be given primary and neutralization treatment.

APPENDIX A

APPLICATION FOR A PERMIT TO CONSTRUCT A TAR SANDS PROCESSING PLANT

1. (1) No person shall commence the construction, extension, or alteration of a plant unless he is the holder of a permit therefore issued by the Director of Standards and Approvals.

(2) An application shall be made by the person who will be the owner of the plant when it is constructed, or his agent.

2. (1) The application for a permit shall be made in writing to the Director of Standards and Approvals at least one year before construction is proposed to commence.

(2) An application for a permit must be accompanied by:

(a) information concerning the plant specified in subsection (3);

(b) at least one scale plan of the area surrounding the land on which the plant is to be situated, showing the matters specified in subsection (4);

(c) at least one scale plant of the land on which the plant is to be situated showing the matters specified in subsection (5);

(d) a flow diagram of the matters specified in subsection (7);

(e) an environmental impact prediction of assessment as specified in subsection (8).

(3) An application for a permit shall contain the following information where applicable, with respect to the

Definition

"plant" means tar sands processing plant

plant.

(a) its general nature and a description of the individual processing unit operations; i.e. mining, bitumen extraction and upgrading, amine regeneration, solvent recovery etc.

(b) the type and quantity of the product resulting from the plant;

(c) size and capacity of equipment used;

(d) type and amount of raw materials used;

(e) type and amount of chemicals used;

(f) the emission rate and concentration of contaminants produced in total per unit of production;

(g) the temperature of any sewage, industrial waste, or other waste or any combination of these, whether treated or untreated plus any admixed land run-off;

(h) the different procedures used in the manufacturing, processing or other operation in the plant that produce different rates of contamination;

(i) the source of the water supply, the amount of water taken in, the amount used and the amount discharged;

(j) a description of the potential danger of an emergency and accidental discharge of contaminants and the procedures that will be instituted following an emergency or accidental discharge.

(4) The scale plans of the area surrounding the land on which the plant is to be situated must show:

(a) the topography of the area;

(b) the type of buildings in the area;

(c) property boundaries, and

(d) the land use of the area.

(5) The scale plans of the land on which the plant is to be situated must show:

(a) the exact location of the processing, manufacturing, storage and other units;

(b) the location of all other buildings;

(c) the sewer lines;

(d) the points of discharge of any contaminant by or from the plant, and

(e) the location of all waste water treatment facilities.

(6) The flow diagram must show:

(a) generally, the processes involved in the plant, and

(b) the manner in which contaminants are produced by the plant; and must be accompanied by a statement of:

(c) the calculated water concentration of every contaminant discharged,

(d) the emission rates and tonnage of water contaminants before and after treatment, and

(e) the chemical composition of all contaminants discharged by or from the plant.

(7) An application for a permit must be accompanied by:

(a) a description of the method of surface water

drainage connected with the plant;

(b) a description of the proposed method of frequency of monitoring waste water and volume flow rate and concentration of contaminants and,

(c) a statement of:

i) the raw materials used in the plant;

ii) the finished product resulting from the plant, and

iii) the materials balance of the matters referred to in clauses (i) and (ii) to the actual contaminants discharged respectively to land, air, and water.

3. Each application for a permit shall be accompanied by the appropriate fee required to be paid under the Clean Water Regulations.

4. Where the Director of Standards and Approvals is satisfied that a permit should be issued, he shall issue a permit in accordance with the Clean Water Act.

APPLICATION FOR A LICENCE
TO OPERATE OR USE A TAR SANDS PROCESSING PLANT

5. (1) No person shall commence the operation or use a plant unless he is the holder of a licence therefore issued by the Director of Standards and Approvals.

(2) An application shall be made by the person who is the owner of the plant or his agent.

6. (1) The application for a licence shall be made in writing to the Director of Standards and Approvals at least 90 days before he proposes to operate or use the plant.

(2) An application for a licence must be accompanied by:

(a) the number of the permit to construct the plant;

(b) detailed information as to any changes to the information supplied under Section (2) with appropriate, new plans, diagrams, and statements.

7. Each application for a licence shall be accompanied by the fee required to be paid under the Clean Water Regulations.

8. Where the Director of Standards and Approvals is satisfied that a licence should be issued, he shall issue a licence in accordance with the Clean Water Act.

9. Where a licence is issued it is valid for a period not to exceed five years from the date of its issue.

January 5, 1973

D R A F T

Alberta

ENVIRONMENT

PERMIT TO CONSTRUCT

PERMIT NO. .....

FILE NO. .....

TO Syncrude Canada Limited
200 Baker Building
EDMONTON, Alberta

.....

Pursuant to section 4 of The Clean Water Act, a permit to construct

the Tar Sands Processing Plant located in the Athabasca Oil Sands as described in the above company's submission to the Energy Resources Conservation Board (Application No. 5849),

is hereby issued subject to the terms, conditions and requirements attached hereto.

Edmonton .....

WP

.....
Director of Standards and Approvals

Syncrude Canada Limited

D R A F T

SECTION ONE: GENERAL

1.1 The plant referred to herein includes those buildings, structures, operating and storage facilities, and land located in Bituminous Sands Lease No. 17, Section 6, Township 93, Range 10, West of the 4th Meridian.

1.2 The plant may be operated up to a maximum capacity of 140,000 barrels per calender day of bitumen feed to upgrading.

1.3 Adequate precautionary measures to control any sulphur dust shall be implemented in order to minimize contamination of the surrounding land and watershed area.

1.4 The disposal of heterogeneous solid waste material shall be conducted in a manner that minimizes potential ground water contamination.

1.5 The company shall at all times conduct and control their operations in such a manner as not to create a hazard to the public and shall take all reasonable precautions to protect and safeguard the lives and property of the public and adjacent property owners.

SECTION TWO: PRECONSTRUCTION REQUIREMENTS

2.1 In a manner satisfactory to the Director of the Division of Standards and Approvals, the company shall submit the following information for his approval:

(a) detailed design information related to the water and waste water management and disposal systems, including the disposal of process waste water, sanitary sewage and surface run-off, prior to the start of any construction;

(b) detailed design information related to plant processes and operations prior to construction of that particular phase;

(c) plans relating to the diversion and relocation of portions of Beaver River, the use of Mildred Lake for tailings disposal and cooling, the increased volumes of water to Poplar Creek, and projections of what the changes in water quality might be for these above mentioned water bodies prior to the start of construction on these projects;

(d) a description of procedures to be used and corrective actions to be taken in the abandonment of any pits, ponds, waste water treatment facilities or any other containment structures at least six months prior to the anticipated time of abandonment;

(e) the overall plan for the final topography of the mining areas as well as proposals respecting revegetation and rehabilitation of these areas prior to the start of any construction;

(f) the overall plan for the abandonment of the plant processing and tailings pond areas, including equipment and structures, at the end of the lifetime of the bitumen recovery project prior to the start of any construction.

SECTION THREE: WATER RELEASE PROHIBITIONS

3.1 All waste waters and water contaminants from the extraction and bitumen upgrading sections of the plant shall be directed to an approved tailings pond.

3.2 All waste waters from the mine pit areas shall be directed to an approved tailings pond.

3.3 All waste waters originating from surface run-off and precipitation from the process areas of the plant shall be directed to an approved tailings pond.

3.4 The release of tailings pond waste water to the surrounding watershed area is prohibited.

3.5 The release of untreated sanitary sewage is prohibited.

3.6 Waste waters originating from surface run-off and precipitation outside the plant process areas shall be collected and controlled from entering the tailings pond and shall be released to specified watershed areas in an approved manner.

SECTION FOUR: MONITORING

4.1 The company shall undertake ecological surveying and monitoring of the surrounding watershed area, especially Mildred Lake and Beaver River, before, during, and after construction, and after plant operations have commenced.

4.2 In a manner satisfactory to the Director of the Division of Standards and Approvals:

(a) cooling water, cooling water blowdown, and boiler water blowdown discharged to Mildred Lake shall be:

i) monitored for volume flow rate in Imperial gallons per day;

ii) monitored for temperature in degrees Fahrenheit;

iii) subject to a continuous fish bioassay test;

iv) subject to analysis of a 24-hour composite sample and analyzed according to the following schedule:

Daily - total suspended solids, chemical oxygen demand, oil and grease, and pH;

Weekly - biological oxygen demand, total sulfides, threshold odor number, ammonia nitrogen, and phenolics.

(b) ground water movement and quality around the tailings pond sites, both before and after construction, shall be:

i) monitored for estimated volume flow rate in Imperial gallons per month;

ii) subject to the analysis of representative grab samples and analyzed according to the following schedule:

Monthly - chemical oxygen demand, oil and grease, pH, phenolics, and total sulfides;

Yearly - heavy metal analysis.

4.3 The company shall establish continuous, automatic monitoring stations on Mildred Lake, the Athabasca River, and Beaver River. The location of stations and parameters to be monitored shall be determined by the Director of the Division of Standards and Approvals.

4.4 The effluent and influent of the sewage treatment plant shall be monitored for biological oxygen demand, total suspended solids, and pH on a weekly basis to determine the efficiency of treatment.

D R A F T

4.5 The volume flow rates and temperatures of all waste waters directed to the tailings pond and the decant water recycled to the extraction plant or other processing operations shall be monitored on a daily basis.

4.6 The company shall, on the basis of the monitoring information specified in this section, prepare a monthly water material balance statement based on the coverage of the daily values obtained.

SECTION FIVE: REPORTING

5.1 A monthly report shall be submitted within twenty days of the end of the month for which the observations were made to the Director of the Division of Pollution Control and shall contain all pertinent information including the following:

(a) the results of the analytical determinations, volume flow rates and monitoring information specified in paragraphs 4.2, 4.3, 4.4 4.5, and 4.6;

(b) the quantity of waste water contained in any waste water treatment pond including any sewage lagoons, or evaporation ponds during the first day of each month and expressed in terms of Imperial gallons and in terms of the percentage capacity occupied to the total volume of each respective pond;

(c) the daily average production in terms of barrels per day of bitumen mined based on one operating month;

(d) the daily average production in terms of barrels per day of bitumen feed to the upgrading plant based on one operating month;

(e) the daily intake of raw water from the surrounding watershed area in terms of Imperial gallons per day based on one operating month;

(f) remarks relative to the sediment removal efficiency of the tailings pond;

(g) remarks relative to the intensity and duration of local precipitation and run-off;

(h) remarks relative to the performance of the complete waste water control program;

(i) remarks relative to the rate of evaporation of water from the tailings pond; and

(j) a monthly material balance statement indicating the quantity and character of incoming process raw materials and chemicals to the plant including chemical additives for process and waste water treatment and their disposition as related to air, water, and land in terms of thousand barrels of crude bitumen to the upgrading plant per operating day.

5.2 All uncontrolled releases of waste waters and water contaminants from the plant, accidental spills of water contaminants to the adjacent watershed area and significant occurrences of non-compliance with any condition of this permit shall be reported to the Director of the Division of

D R A F T

Pollution Control within 24 hours of discovery. The company shall immediately activate contingency procedures to prohibit water pollution or any other environmental hazard.

5.3 The company shall report or confirm to the Director of the Division of Pollution Control any awareness of the occurrence of non-compliance with any condition of this permit in writing within 72 hours of their becoming aware of such contravention.

5.4 An annual summary and evaluation report of the performance of all waste water treatment facilities and control systems shall be prepared and forwarded to the Director of the Division of Pollution Control by February 14. This annual report shall include remarks on extensions and alterations and photographs or 35 mm. slides of all waste water treatment facilities.

5.5 The company shall report the monitoring information specified in paragraph 4.1 when the material becomes available.

OUTLINE OF THE REQUIREMENTS

REGARDING

LAND RECLAMATION

TO TAR SANDS

DEVELOPMENT

LAND RECLAMATION

A. Objective

The primary objective of the Department in land reclamation of the Syncrude Canada Ltd. lease is to ensure that the land surface will be left in a condition that will not limit future development and use following the completion of mining operations.

The purpose of this section is to inform Syncrude Canada Ltd. of the standards, conditions, and procedures that will be used in the review of land reclamation plans.

B. Conditions and Procedures

1. Conditions

(a) The company will be subject to the provisions of the Surface Reclamation Act and or any subsequent reclamation legislation and must obtain a Reclamation Certificate prior to the termination of any surface lease agreements.

(b) The company shall post a security deposit, calculated on a per acre basis, sufficient to cover reclamation costs incurred for the period of this agreement. The per acre cost shall be negotiated and established by the company and the Department within 30 days of acceptance of this agreement by the company.

(c) The standard of land reclamation shall conform with the soil, topography and vegetation of the surrounding natural area.

(d) Soil surveys and laboratory analysis of soil samples shall be of a standard equal to that of the Alberta Soil Survey.

(e) Sufficient overburden shall be available to provided an adequate root zone medium for the re-establishment of vegetation following the completion of sequential mining phases.

(f) The company shall file an environmental impact statement specific to surface disturbance.

B. Procedure

The company shall submit to the Department a land reclamation plan which shall include the following information:

1. The final condition of the site. To this end the company shall provide:

(a) Scaled cross sections and contours of the final land surface showing how the man made features fit with the surrounding natural terrain.

(b) Plates illustrating completed reclamation for each stage which shows the type of surface and subsurface material, vegetative cover, and provisions for control of surface runoff. The type of material used for the root zone must provide adequate soil moisture holding capacity to maintain vegestation during the average

growing season.

(c) An artist's illustration showing the final features of the site following reclamation.

2. The time and sequence schedule of reclamation activities in relation to the mining operation.

3. The stability of loaded slopes and overburden spoil deposits, based on the results of a foundation investigation and the inherent properties of the spoil material from a long term point of view.

WATERSHED PROTECTION

The existing watershed characteristics should be thoroughly studied and detailed plans worked out describing the final watershed characteristics and how they are to be attained and maintained.

GROUNDWATER

(1) The company will submit as part of their development plan, a groundwater management report* which shall include among other things:

(a) a geological report of the area, based on the results of exploratory drilling and excavation, including elucidation of the stratigraphy, lithology and structure of both overburden and bedrock.

(b) a general hydrogeological study of the entire area of the lease to:

1. establish recharge and discharge areas, rate of present groundwater discharge and areas of springs, seepage areas and salt precipitates.
2. determine the depth to water table, the piezometric water levels and the water bearing zones.

(c) chemical analysis of groundwater samples obtained during drilling and excavation, and from springs and seepage areas.

*See Water Resources Act requirements...Item 2 Page 10.

(d) groundwater regime parameters, with particular reference to:

1. groundwater flow systems,
2. volumes of groundwater discharge.

(e) a prognosis of changes to be caused to groundwater regime, permeability, rate of groundwater discharge, and any anticipated degradation of groundwater quality as a result of mining activity.

Where important groundwater aquifers are present, an evaluation will be required of the general effect of surface mining on the groundwater regime, both during mining operations and after completion of reclamation.

SURFACE WATER

(2) The company should prepare also a Surface Water Management Report which shall be related to the mining activities that involve surface water and shall include:

(a) all engineering data and design details for all:

1. water flow control structures,
2. water diversion structures,
3. drainage structures,
4. erosion control and watershed protection structures,

and

5. roads and bridges.

(b) analysis of the present character of streams or rivers that are being diverted or impounded, that is:

1. annual mean flow, (if available)

2. monthly mean flow, (if available) and
3. expected flow from snow melt and storm runoff from the watershed and the expected flooding patterns therefrom.

(c) information detailing the expected effects of the operation on the natural channel pattern of the area.

ECOLOGICAL BASELINE DISCUSSION

Date: November 23, 1972

Present:

Ron Goforth	Syncrude
Joe Milos	Dept. of Environment - S. and Approvals
D. N. Blades	ERCB
L.D.M. Sadler	Dept. of Environment - Water Resources
Doug Harrington	Dept. of Environment - Interdepartmental Planning
Jim Leeper	Syncrude
Gerhardt Hartman	Dept. of Environment - Interdepartmental Planning Div.

DATE DUE

JUN 15 '80

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